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Technical Report 823

Delayed Entry Program (DEP) Loss Behavior

Abraham Nelson
Army Research Institute

September 1988

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Losses from the Delayed Entry Program are becoming an increasing problem. This research examines this problem from a macro and micro perspective. First, an aggregate time series model is specified and estimated to determine those factors affecting DEP loss trends. A microdata model that uses a binary logistic regression approach to examine individual characteristics, enlistment policies, and environmental conditions affecting the probability of DEP loss is then estimated. From this research, high-risk DEP loss groups can be identified.

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Delayed Entry Program (DEP) Loss Behavior

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FOREWORD

The Manpower and Personnel Policy Research Group of the Army Research Institute for the Behavioral and Social Sciences (ARI) conducts research on significant U.S. Army recruiting programs and policy issues. One major recruiting research issue is losses from the Delayed Entry Program (DEP). This research attempts to identify factors that influence losses from the DEP in order to more efficiently and effectively manage it.

This report was prepared as part of the Program Task in recruiting and retention of the Manpower and Personnel Research Laboratory. The research reported was conducted at the request of the U.S. Army Recruiting Command (USAREC), and the results were briefed to the Commander, USAREC, on 12 April 1988. The Army can use the findings of this research to forecast DEP losses, and to identify individuals most likely to become DEP losses.

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DELAYED ENTRY PROGRAM (DEP) LOSS BEHAVIOR

EXECUTIVE SUMMARY

Requirement:

The problem of losses from the Delayed Entry Program (DEP) is an important management issue for the U.S. Army Recruiting Command (USAREC). This research provides the Army with an understanding of the factors influencing DEP loss among "quality" recruits and thereby leads to more efficient and effective management of the program.

Procedure:

Two models of DEP loss are developed: A time series model is used to examine DEP loss for the entire Army against selected factors hypothesized to be related to DEP loss. A microdata model is then estimated to determine factors that influence the DEP loss behavior of individuals.

The time series model is estimated with data supplied by USAREC covering fiscal years (FY) 1984 through 1987. The factors considered are the youth unemployment rate, average DEP length, and the number of individuals in the DEP per recruiter. An ordinary least squares technique is used to estimate the model. This model specification is tested for autocorrelation.

Microdata models are estimated using FY86 and FY87 recruit contract files to determine individual characteristics, enlistment policies, and environmental conditions. These Factors include age, Armed Forces Qualification Test (AFQT) score, contracted DEP length, educational status, Army College Fund (ACF) participation, enlistment bonus participation, term of enlistment, and enlistment brigade. A binary logistic regression technique is used to estimate these models.

Findings:

The youth unemployment rate, average DEP length, and size of the DEP per recruiter were all found to have a significant influence on the DEP loss rate trends in the time series model. Unemployment rate was the single most substantial factor influencing the DEP loss rate. The estimated equation indicated that nearly 40 percent of the DEP loss rate increase between FY86 and FY87 was attributable to the decline in the youth unemployment rate.

In the microdata analysis, several factors were found to significantly influence the probability of an individual's becoming a DEP loss. Among these were DEP length, age, and AFQT score. DEP length and age were found to have positive impacts on the probability of becoming a DEP loss, and AFQT score had a negative impact.

The results for the ACF and enlistment bonus participation variables were inconsistent across the models estimated for FY86 and FY87. Their signs were different in each model. The ACF participation variables were not significant in the FY87 model and significant in the FY86 model. The opposite was true for the bonus participation variable.

Utilization of Findings:

USAREC can use the results of this research to manage the DEP, to forecast DEP losses and adjust recruiting missions accordingly, and to identify individuals most likely to become DEP losses.

DELAYED ENTRY PROGRAM (DEP) LOSS BEHAVIOR

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DELAYED ENTRY PROGRAM (DEP) LOSS BEHAVIOR

INTRODUCTION

The Delayed Entry Program (DEP) is a recruiting mechanism used by the U.S. military services, allowing an individual to sign an enlistment contract and to delay reporting for active duty up to 12 months. It is an important management tool which is extensively used by all of the services. An individual signing an enlistment contract who goes on active duty immediately is called a "direct ship"; otherwise he or she enters the DEP. The vast majority of recruits enter the Army through this program. The DEP expedites the smooth flow of accessions into the Army's training base and improves both the Army's recruiting and training productivity.

The DEP, however, has become an increasing problem. More individuals are becoming DEP losses; they are leaving the DEP and are not reporting for active duty. The DEP loss rate for high school diploma senior and graduate males scoring at or above the fiftieth percentile on the Armed Forces Qualification Test (AFQT), referred to as GSMAs, has increased by 15 percent from FY86 to FY87 (USAREC Commanders Conference, September 1987). In absolute numbers this meant that an additional 1,098 GSMA individuals were lost from the DEP during the first ten months of FY87.

In this paper the DEP loss problem is examined and a model is developed and estimated to investigate the causes of the upward trend in the DEP loss rate. Aggregate and micro-level data are used to explore those factors affecting DEP loss and to help identify high risk DEP loss groups.

The results of this research can be used to forecast DEP loss rate trends and to identify individuals in high risk groups--individuals who are most likely to become DEP attritions. The managers of recruiting programs can use forecasts of DEP loss trends to assist in the development of new policies or in the adjustment of current initiatives to compensate for the adverse impacts of forecasted losses. Furthermore, if high-risk DEP groups can be identified, this information can be used to reduce the likelihood of DEP losses.

In the first part of this paper a time series approach is used to examine Army DEP loss from a macro perspective. An analysis of DEP loss from a micro level is presented in the latter part of this paper. The final section summarizes the research results, discusses how these results may be utilized, and identifies directions for further research.

DEP LOSS

There are several positive aspects of the Delayed Entry Program. First, this program permits the Army to smooth out the training load. The scheduled active duty date for an Army recruit is determined by the date and availability of the appropriate training course open to him or her. Second, as Morey (1983) postulated, individuals in the DEP provide referrals from their peers and, hence, increase the production of recruiters. Finally, Phillips and Schmitz (1985) found that those individuals who enter active duty after

spending time in the DEP have lower in-service attrition rates than those who do not participate in the DEP (ceteris paribus).

There are also some negative aspects to the DEP. First, time in the DEP is associated with lower probability of shipping (Phillips & Schmitz, 1985; Celeste, 1985; and Quester & Murray, 1986). A second drawback is that it is necessary to use recruiting resources, especially recruiter time, to manage DEP which could have been employed in other activities. However, the most significant drawback of this program is DEP losses -- individuals in the DEP who decide to abrogate their enlistment contracts. At the present time, the Army does not force individuals to fulfill their contractual enlistment obligation.

DEP losses adversely affect recruiting productivity as recruiter effort and other resources are wasted when an individual becomes a loss. To compensate for such losses additional enlistment contracts must be obtained. This requires the expenditure of additional resources, including recruiter time.

Finally, the Army's ability to smooth the flow of individuals into training slots during the year is also diminished as a result of DEP losses. Because training slots may, in fact, go unfilled because of DEP losses, scarce training resources are wasted.

Several research efforts have investigated DEP loss. Morey (1983), among the first to analyze the DEP, was concerned with the Navy's management of the program. He pointed out some of the indirect effects, such as recruit referrals, which are realized from the DEP. Celeste (1985) used a cohort methodology to investigate DEP loss in the Army and found that the following individual characteristics differentiate DEP losses: gender, education, and AFQT scores. She also found that the length of time in the DEP was related to DEP loss; as DEP length increased the probability of being a DEP loss increased. Phillips and Schmitz (1985) estimated a microdata model of Army DEP attrition using a logistic regression approach, while Quester and Murray (1986) analyzed DEP losses in the Navy using a similar approach.

The Phillips and Schmitz (1985) and Quester and Murray (1986) papers are particularly relevant to the micro analysis of DEP loss. Phillips and Schmitz estimated microdata-level models of DEP loss using data from the first six months of the FY82 and the FY83 USAREC Minimaster contract files. They found the following factors statistically significant at the .10 level in at least one of their models: race, age, a four year enlistment term, enlistment bonus, Army College Fund (ACF), AFQT, sex, education level, and days in DEP. The following factors were found to be negatively correlated with DEP loss: non-white, age, ACF, and AFQT. They also found that contracted days in the DEP and being a female recruit were positively correlated with DEP loss.

Quester and Murray included all of the factors noted above except term of enlistment and ACF, which were not available in the Navy. Other factors considered in this model were the program enlisted for, month of enlistment, average number of recruits in the DEP per recruiter, and recruiting area.

They found the following: (a) female recruits and younger male recruits were more likely to be DEP losses, (b) Navy enlistment incentive programs did not make a difference, (c) there were differences between regions of the country, (d) DEP loss appeared higher when the DEP pool is largest, and (e) the average monthly DEP size per recruiter was positively correlated to the probability of being a DEP loss.

The DEP loss behavior of GSMAs is of particular interest to the Army since GSMAs are supply constrained. The cost of recruiting a GSMA is greater than the cost of recruiting other individuals. However, the attrition rates for individuals in this group are less than those in other groups. Hence, although it cost more to the recruit GSMAs some of the costs are offset since they leave at lower rates. Also, AFQT scores are significantly correlated with increased performance as measured by the Skill Qualifications Test (Armor, Fernandez, Bers, & Schwarzbach, 1982). For the above reasons it is desirable for the Army to recruit as many GSMAs as possible and not lose them from the DEP. The focus of this report is therefore on GSMA DEP loss.

THE MACRO LEVEL APPROACH

To examine DEP loss from a macro level an aggregate time series model was used. The objective was to determine those factors affecting trends in aggregate DEP loss rates. If the impact of factors which affect DEP loss, such as the youth unemployment rate, can be determined then this approach will make it possible to anticipate potential DEP losses and to adjust policies to mitigate these losses.

Time Series Model

First, it is hypothesized that the length of time in the DEP, which was found to be significantly related to DEP loss in the research noted earlier, increases the probability of a DEP loss.

Environmental factors such as labor market conditions may also influence DEP loss. Previous models, however, have not taken into account such economic factors. It is an accepted fact that youth unemployment significantly influences Army enlistments. Hence, it was not unreasonable to conjecture that it also influences individuals' decisions to fulfill their contract obligations.

In addition, it was assumed that the number of individuals in the DEP relative to the number of recruiters influences DEP loss. The number of individuals per recruiter affects the amount of time recruiters can spend managing each contract. The less time a recruiter has to manage individuals in the DEP the greater the probability they will become DEP losses.

The model estimated here used monthly time-series data covering fiscal years (FY) 1984 through 1987, and takes the form:

$$DEPLR = \beta_0 + \beta_1 * UNEM + \beta_2 * AVDEPL + \beta_3 * DEPREC + ERROR\ TERM$$

where DEPLR is the DEP loss rate (number of DEP losses)/(DEP losses + accessions) of high school graduate or senior males scoring in the top half of the Armed Forces Qualification Test (GSMA). Independent variables included are UNEM, the unemployment rate for 16-to 19-year olds; AVDEPL, the average DEP length (in months) for the period; and DEPREC, the number of individuals in the DEP per recruiter. The mean values and the standard deviations of these variables are reported in appendix A. An ordinary least squares (OLS) technique was used to estimate the model. This specification assumes that the random disturbances are uncorrelated. If the disturbances are correlated for a linear regression model involving time series data, then autocorrelation is said to be present. The Durbin-Watson test for autocorrelation was employed here and, at 1.45, does not strongly indicate that the assumption of uncorrelated disturbances is violated.

Results

The estimated coefficients and t-statistics are presented in Table 1. All variable coefficients are significant at the .01 level, and all have the expected signs. The estimated coefficient for the youth unemployment rate variable measures the effect of changes in the youth unemployment rate on the DEP loss rate; an absolute increase of 1 percent in youth unemployment is associated with an absolute decrease of .67 in the loss rate. Similarly, an increase of one month in average DEP length increases the DEP loss rate by over 0.5 percent. An increase of one in the ratio of the size of the DEP to the number of recruiters, which is the result of either reducing the number of recruiters or expanding the size of the DEP pool, increases the DEP loss rate by over 1.9 percent. R^2 and the mean square error (MSE) for the model

Table 1

Ordinary Least Squares Regression Results for DEP Loss Model
(Monthly Data 1984-87)
(Dependent Variable: DEP Loss Rate)

Independent Variable	Estimated Coefficient	t-Statistic
Unemployment	-.670	-3.594*
Average DEP Length	.542	4.508*
DEP per Recruiter	1.931	4.483*
Intercept	8.950	2.038*

Adjusted R-Squared = .70
Mean Square Error = 1.37
Durbin-Watson Statistic = 1.45

* Significant at the .01 level.

are also reported. These statistics indicate that the variables explained 70% of the change in DEP loss over the FY84-87 period, and estimated the monthly DEP loss with average mean squared error of about 1.4 percent.

The model was used to examine the impact of each factor on the change in the GSMA DEP loss rate between FY86 and FY87. The actual differences for all variables for FY86 versus FY87 are presented in Table 2. They indicate that: (a) the labor market became more competitive -- unemployment dropped about one and one half percentage points; (b) the demand on recruiter time increased; and (c) the amount of time available for a recruit to become an attrition from the DEP increased. With these changes, an increase in the DEP loss rate should have been anticipated and, in fact, was realized.

Table 2

Differences Between FY86 AND FY87 Variables

	DEP Loss Rate	Unemployment Rate	DEP per Recruiter	Average DEP Length
FY86	7.18	19.52	4.775	4.267
FY87	9.88	18.09	5.025	4.765
Difference	2.70	-1.43	.25	.49
Percent Difference	37	-7	5	16

The changes in the observed and predicted DEP loss rate between FY86 and FY87 and the contributions of each factor to these changes are presented in Table 3. The changes for the observed and predicted rates are 2.70 and 1.71, respectively. This disparity represents a 37 percent underprediction of the DEP loss rate by the equation. This underprediction may reflect a one-time policy change that took effect in January 1987. It was at this point that nongraduates from the previous summer who failed to obtain their diploma were purged from the DEP. This may be the reason the model underpredicts the losses for January 1987 by over five percent (See appendix B.).

All model factors contributed to the increase in the DEP loss rate. However, the unemployment rate of 16 to 19 year olds influenced the changes in the observed and predicted DEP loss rates more than any other factor. In fact, nearly 40% of the increase in the actual loss rate and 56% of the increase in the predicted loss rate were attributable to declining unemployment alone. The other factors contributed to the increases in both loss rates to a lesser extent. (See Table 3).

The actual and predicted DEP loss rates and the errors in the prediction, the residual, for each month from FY86 through FY87 are reported in appendix B.

Table 3

Factor Contribution to FY86-FY87 DEP Loss Rate Change

		Factor Contribution			
	DEP Loss Rate Change	Unemployment Rate	DEP per Recruiter	Average DEP Length	Error
Observed Loss Rate	2.70	39%	18%	10%	33%
Predicted Loss Rate	1.71	56%	28%	16%	0%

Conclusions

Overall, the model specified in this effort is appropriate. An $R^2 = .70$ indicates that the equation fits the data. All factors included — unemployment, DEP per recruiter, and average DEP length — significantly affect DEP loss.

Although the equation estimated here underpredicts the change in the DEP loss rate from FY86 to FY87, it does account for a substantial proportion of the actual loss rate. Moreover, the estimated equation indicates that nearly 40% of the increase in the loss rate was due to one factor, the decline in the 16- to 19-year old unemployment rate.

THE MICRO LEVEL APPROACH

A microdata model of DEP loss was then developed and estimated to determine factors affecting the probability that an individual becomes a DEP loss. This research extends the models developed earlier by Phillips and Schmitz (1985) and by Quester and Murray (1985). Individual level data on GSMAs, was used to quantify the impact of individual characteristics, enlistment policies, and environmental conditions which explain DEP loss.

Microdata Model

Individuals attempt to maximize the value of their job choice. When individuals sign an enlistment contract they have judged that the value of the Army job is greater than all other alternatives. While in the DEP an individual may continue to evaluate his choice as additional information is obtained. Job offers from the civilian sector or other military services, changes in the perception of Army life or the MOS assignment, or the acquisition of knowledge of educational opportunities may change the perceived value of an Army enlistment and may be the cause of a DEP loss.

Those individuals failing to fulfill their DEP contract exhibit quit behavior. The Army is passive in the DEP loss decision. While the Army is obliged to comply with an enlistment contract, the individual may abrogate it

with impunity. The Army does not force individuals to comply with their contract.

The individual characteristics examined were age, AFQT score, educational status, and whether the individual has dependents or not. The enlistment policies examined were ACF participation, whether he contracted for an enlistment bonus, term of enlistment, and contracted DEP length. Brigade dummies were used as surrogates of the environmental factors of the community from which the recruit enlisted.

The factors above were presumed to influence the probability that a recruit becomes a DEP loss. The following specific hypotheses were tested:

(1) Age is negatively related to DEP loss. Other researchers have found that job turnover is greatest among younger individuals.

(2) AFQT is positively related to DEP loss. Since AFQT is a measure of mental ability then individuals with high AFQT scores should have more job options and educational opportunities than those with lower scores. Thus, the higher the AFQT score the more likely an individual is to be a DEP loss.

(3) Contracted DEP length is positively correlated with DEP loss. The longer an individual is in the DEP the more opportunities he has to reevaluate his job choice.

(4) The behavior in the DEP of high school graduates and high school seniors is different. Seniors have less job market experience than high school graduates. Thus, seniors would be less likely to drop out of the DEP.

(5) Participation in the ACF or the enlistment bonus program increases the value of Army job to the individual. Hence, participating in these programs should be negatively related to the probability of DEP loss.

(6) Those individuals with dependents are more risk averse than those without dependents. The more risk averse an individual the less likely he is to change jobs. This implies that individuals with no dependents are more likely to be DEP losses than those without dependents.

(7) As terms of enlistment increase the probability of becoming a DEP loss increases.

(8) Local labor market conditions affect DEP loss. These conditions are not the same in all regions of the country. Brigade dummies are included to capture the effects of these local labor market conditions.

It was also hypothesized that the impacts of certain factors on the probability of becoming a DEP loss were not linear and that some factors interacted. As a result, squares of age and DEP length were included in the

model. If these factors were statistically significant this would imply that the marginal DEP loss rates with respect to these factors were not constant. The interaction of educational status with DEP length and DEP length squared were also considered here. These were included to investigate whether the impact of DEP length on DEP loss was different for individuals with different educational status.

A binary logistic regression (logit) model is specified here. Let T be the random variable with the logistic distribution, $F(t)=e^t/(1+e^t)$. Suppose that Y=1 indicates a DEP loss if and only if $t \leq \Sigma_i \beta_i X_i$. Then

$$P(Y=1) = P(T \leq \Sigma\beta_i X_i) = e^{\Sigma\beta_i X_i}/(1+e^{\Sigma\beta_i X_i})$$

which is equivalent to

$$P(Y=1) = P(T \leq \Sigma\beta_i X_i) = 1/(1+e^{-(\Sigma\beta_i X_i)}),$$

where P(i) is the probability that the i^{th} individual becomes a DEP loss; β_i are logistic regression coefficients; and X_i are the factors associated with the i^{th} individual.

Care must be taken in the interpretation of the coefficients of a logistic regression model. The estimated coefficients do not indicate the increase in the probability of a DEP loss given a one unit increase in the factor associated with that coefficient. Rather, the coefficients indicate the increase of log(P(i)/(1-P(i))), the log odds of a DEP loss, for an increase in a factor. A more intuitive interpretation is obtained by computing the exponential of the coefficients. The computed result for a coefficient indicates the amount by which the probability of DEP loss is multiplied for a one unit change in the factor associated with that coefficient.

Models were estimated using FY86 and FY87 USAREC Minimaster contract files. After eliminating open records and those with invalid information for the factors being analyzed, there were 87,997 and 73,233 observations remaining in the FY86 and FY87 files, respectively.

Results

The variables in the model were age, age squared, DEP length (in months), DEP length squared, AFQT, education (high school degree graduates - HSG, high school seniors - SEN), ACF participation (ACF_YES, ACF_NO), bonus participation (BONUS_YES, BONUS_NO), dependent status (Depend_Yes, Depend_No), term of enlistment (TERM_2, TERM_3, TERM_4), the interaction of DEP length and education, the interaction of DEP length squared and education, and dummies for each brigade (BDE_3, BDE_4, BDE_5, AND BDE_6). The omitted categories were no ACF, no Bonus, dependents, four-year term of enlistment, and brigade 1.

The means for the variables in the model for FY86 and FY87 are reported in Table 4. A comparison of means for the fiscal years finds that the differences are very small for the majority of the variables. For example,

there was only a .82 percent increase in the DEP length between FY86 and FY87. Note however, that there were substantial changes between FY86 and FY87 in participation for the Army's enlistment incentive programs: ACF and the bonus program. Participation in the ACF decreased by 20 percent between FY86 and FY87. The decrease in enlistment bonus participation was even greater: a 43 percent decrease occurred. DEP loss rates are also reported for each fiscal year in Table 4. Note that a 14 percent increase in the DEP loss rate occurred.

Table 4

Characteristics of the FY86 and FY87 Minimaster Data Sets

Variable	Value	N=87,997 FY86	N=73,233 FY87
DEP Loss	Rate	8.4	9.6
Age	Mean	20.60	20.00
AFQT Score	Mean	70.96	70.90
DEP Length	Mean	4.84	4.88
Education	Senior	35.09	36.19
	HSDG	64.91	63.81
ACF Participant	Yes	50.96	40.74
	No	49.04	59.26
Bonus	Yes	35.25	19.71
	No	64.75	80.29
Dependents	Yes	11.59	11.73
	No	88.41	88.27
Term	2	18.42	19.71
	3	35.25	37.98
	4	46.33	42.31
Brigade	1	20.30	19.22
	2	18.76	18.76
	4	16.58	18.41
	5	26.51	26.17
	6	17.85	17.44

The results from the estimation of the two logistic regression models for 1986 and 1987 are reported in Tables 5 and 6. The coefficients and their standard errors are reported for both tables. The * (**) indicates that the factor is statistically significant at the .01 (.05) level.

The model results determined that many individual characteristics, environmental factors, and enlistment incentives affect the probability of DEP loss. As an individual grew older or their contracted DEP length increased the likelihood of them becoming a DEP loss increased. These rates were increasing at decreasing rates since the signs of their square terms were found to be negative. However, of the square terms only age squared was found to be statistically significant. Seniors had higher DEP loss rates than graduates. The probability of DEP loss decreased as AFQT increased.

Note that the coefficients for age and AFQT did not have the expected sign. Age was hypothesized to be negatively related and AFQT positively related to DEP loss. The results did not support these hypotheses.

Table 5

Results of Microdata Model for FY86

Variable	Estimated Coefficient	Standard Error
Intercept	-12.621*	0.589
Age	0.422*	0.049
Age Squared	-0.006*	0.001
DEP Length	0.350*	0.025
DEP Length Squared	-0.001	0.002
AFQT	-0.005*	0.001
Senior	0.547*	0.180
ACF_Yes	-0.120*	0.030
Bonus_Yes	-0.022	0.038
Depend_No	3.032*	0.137
Term_3	-0.108*	0.037
Term_2	0.194*	0.047
DEP Length*Senior	-0.071	0.050
DEP Length Squared* Senior	-0.002	0.003
Brigade 2	-0.061	0.040
Brigade 4	-0.229*	0.044
Brigade 5	-0.166*	0.036
Brigade 6	-0.116*	0.040

FRACTION OF CONCORDANT PAIRS OF PREDICTED PROBABILITIES AND RESPONSES: 0.74
R = 0.35
MODEL CHI-SQUARE = 6264.53 WITH 17 D.F.
(-2 LOG L.R.) P = 0.0

* Significant at the .01 level.

The results from both models suggested that having no dependents was positively correlated with the probability of being a DEP loss. In fact the coefficients for this variable were the largest in absolute value in both models. This indicated that they had the most influence on the probability of DEP loss. But also note that the differences in the coefficients between models were largest for this variable suggesting a lack of precision in the estimated impact.

Other variables such as term of enlistments and the brigade dummies were not found to be statistically significant in all instances. The brigade dummy for the third brigade in the FY86 model was not significant. This was also the case for the two-year term of enlistment in the FY87 model.

Table 6

Results of Microdata Model for FY87

Independent Variable	Estimated Coefficient	Standard Error
Intercept	-10.331*	0.598
Age	0.391*	0.050
Age Squared	-0.006*	0.001
DEP Length	0.325*	0.026
DEP Length Squared	-0.001	0.002
AFQT	-0.005*	0.001
Senior	0.564*	0.179
ACF_Yes	0.051	0.035
Bonus_Yes	0.107*	0.039
Depend_No	1.359*	0.071
Term_3	-0.118*	0.035
Term_2	0.011	0.046
DEP Length*Senior	-0.039	0.051
DEP Length Squared* Senior	-0.005	0.004
Brigade 2	-0.097**	0.041
Brigade 4	-0.322*	0.045
Brigade 5	-0.116*	0.037
Brigade 6	-0.168*	0.042

FRACTION OF CONCORDANT PAIRS OF PREDICTED PROBABILITIES AND RESPONSES: 0.72
R = 0.32
MODEL CHI-SQUARE = 4614.86 WITH 17 D.F.
(-2 LOG L.R.) P = 0.0

* Significant at the .01 level.
** Significant at the .05 level.

However, the signs of the coefficients for these variables were consistent across models.

The results of the models were inconsistent for the ACF and enlistment bonus program. ACF participation was statistically significant in the FY86 model and bonus program participation was not. The reverse was true for the FY87 model. In addition, the signs were negative in the FY86 model and positive in the other model.

Observe that the signs of the estimated coefficients were consistent across models except for the coefficients of ACF and bonus. Also, the magnitudes of the coefficients were approximately the same in both models except for the intercept term and dependent status.

An F-test of the chi-square summary statistics for each model are reported in Tables 6 and 7. It indicates that at least one of the factors affects the probability of being a DEP loss in each instance. A pseudo-R^2 is reported in both tables. As expected, they are small: R^2=.35 for the FY86 model and R^2=.31 for the FY87 model. The percent of correct predictions for the model data is also provided in each table. The respective statistics of 73 and 72 percent indicate that the explanatory power of each model is statistically significant.

The effect of several of the factors on the probability of DEP loss for high school graduates and high school seniors was examined in more detail. These factors were time in the DEP, age, AFQT score, brigade differences, and dependent status. While these factors were varied the others were held at their mean values.

The DEP loss probabilities for high school seniors and graduates for various DEP lengths are reported in Figures 1 and 2 for FY86 and FY87, respectively. As DEP length increases, the probability of being a DEP loss increases. In both instances seniors drop out of the DEP at a constant rate, whereas graduates increase substantially beyond six months. The DEP loss probabilities for seniors exceed those of the high school graduates during the first three months. After this point, however, the graduate probabilities exceed those of seniors. The differences between these two increases rapidly after the fourth month. The high school graduate probability is approximately double that of seniors for a DEP length of eleven months in both models.

Figures 3 and 4 present DEP loss rates for the FY86 and the FY87 models for seniors and graduates where age is allowed to vary from 17 to 35 years for graduates and from 17 to 21 years for seniors, holding all other factors at their means. These figures indicate that older individuals are more likely to become DEP losses. The graduate DEP loss probabilities exceed the seniors' in all instances. Note, however that the differences are very small.

In figures 5 and 6 the DEP loss probabilities for both models are presented for seniors and graduates at various AFQT levels while holding the other factors, as before, at their means. The higher an individual's AFQT score the less likely he is to be a DEP loss. The graduate probabilities exceed the seniors' in all cases. The differences between the two are approximately the same for all AFQT levels. There is a decline of approximately 19 percent in the DEP loss probability as AFQT scores increase from the 50th to the 90th percentile. This means that AFQT category I individuals have about 1.3 percent lower DEP loss probabilities than AFQT category IIIA individuals.

The DEP loss probabilities for each brigade and year are presented in figures 7 and 8 for graduates and seniors, respectively. These probabilities are estimated for the average individual in each brigade for each year. (These averages are reported in Appendix D.) The FY87 DEP loss probabilities exceed those for FY86 in all brigades for both graduates and seniors. The differences, however, are much larger for graduates. Also

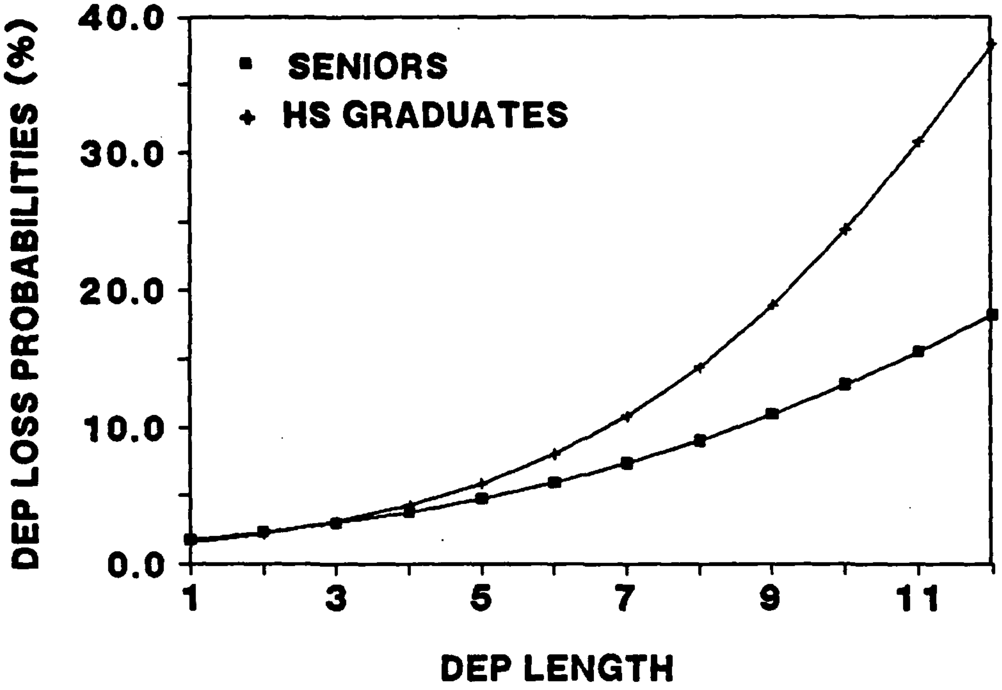

Figure 1. DEP loss probabilities for FY86 GSMA contracts by DEP length.

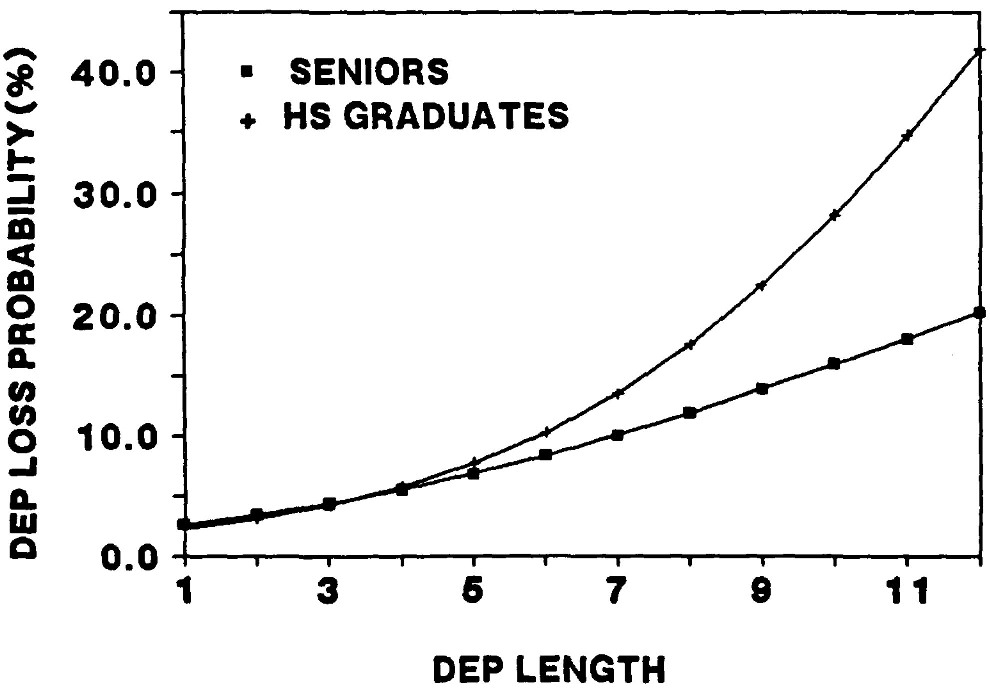

Figure 2. DEP loss probabilities for FY86 GSMA contracts by DEP length.

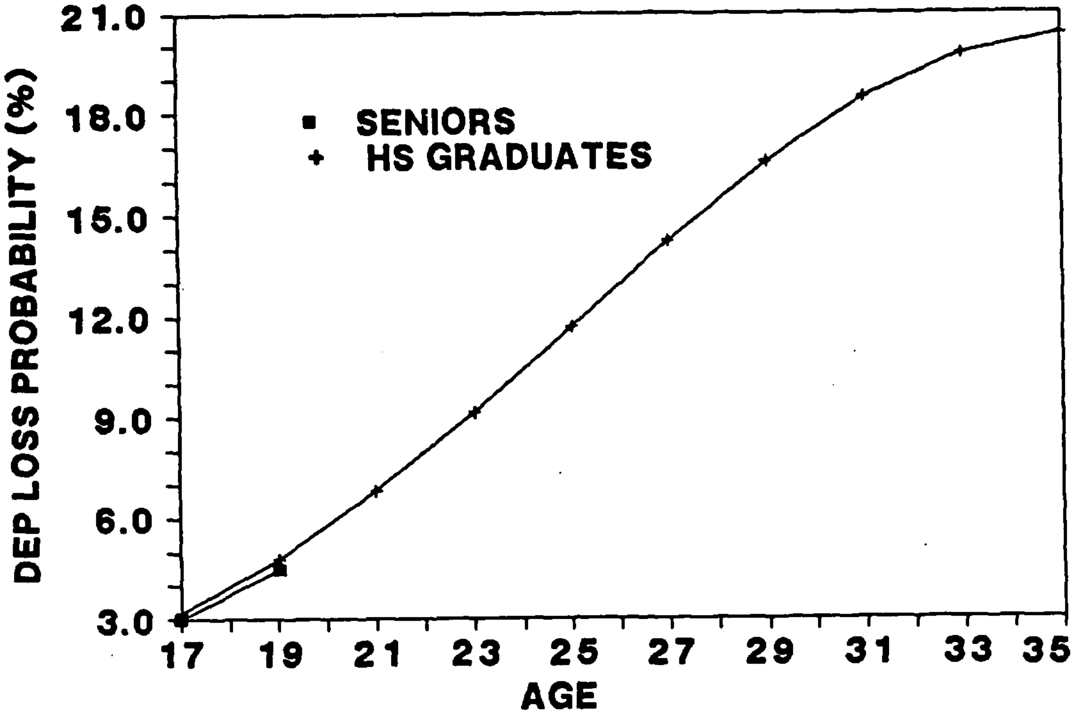

Figure 3. DEP loss probabilities for FY86 GSMA contracts by age.

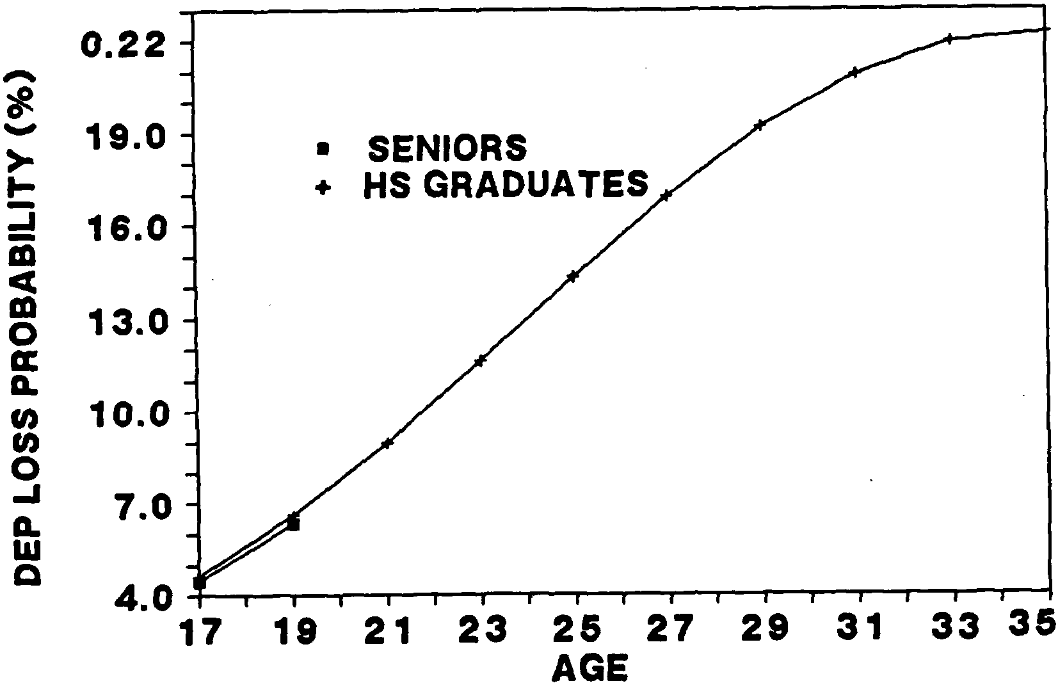

Figure 4. DEP loss probabilities for FY87 GSMA contracts by age.

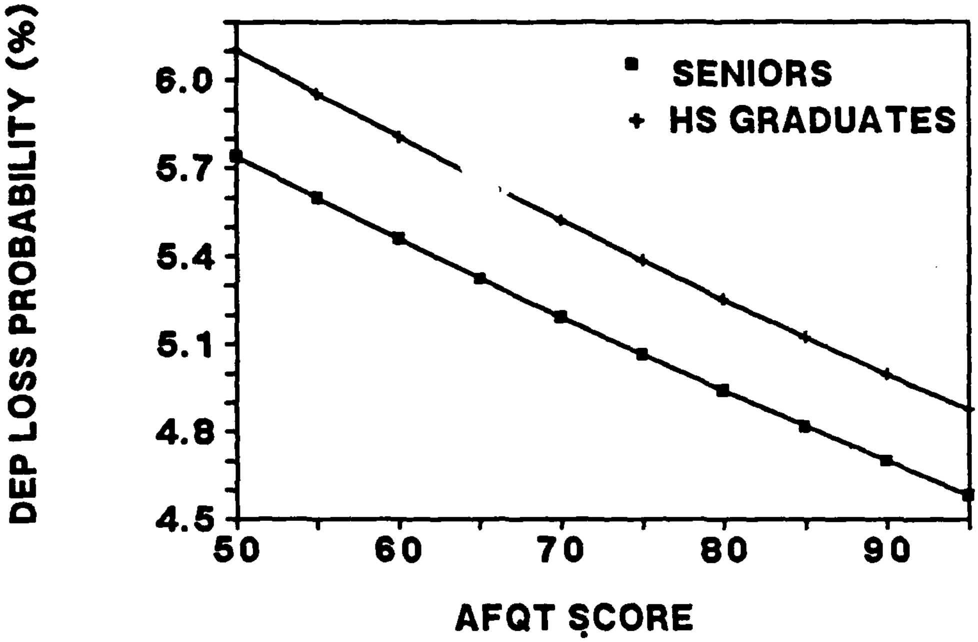

Figure 5. DEP loss probabilities for FY86 GSMA contracts by AFQT score.

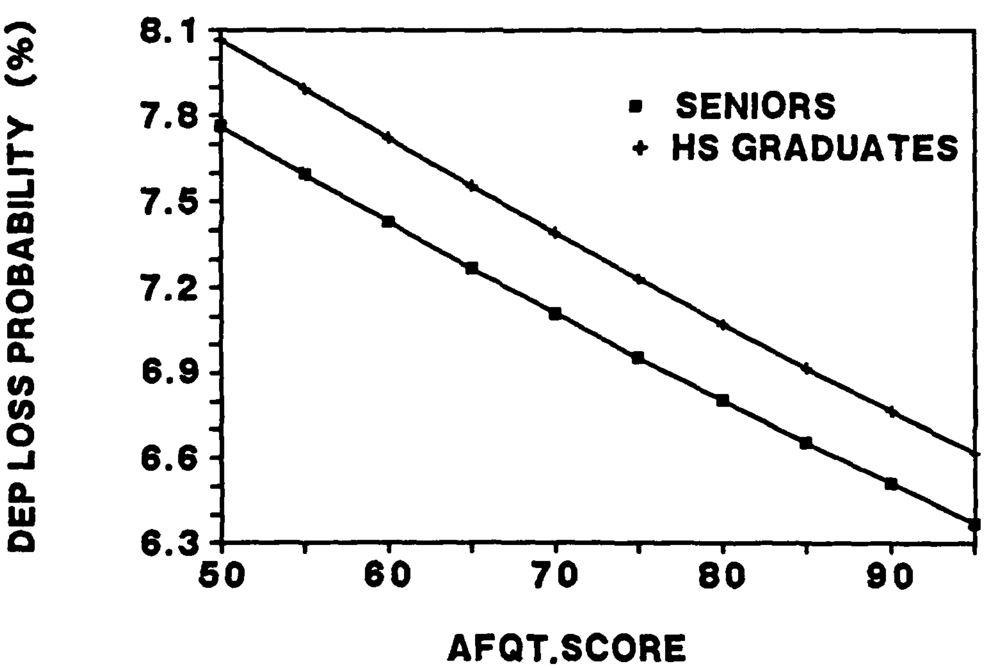

Figure 6. DEP loss probabilities for FY87 GSMA contracts by AFQT score.

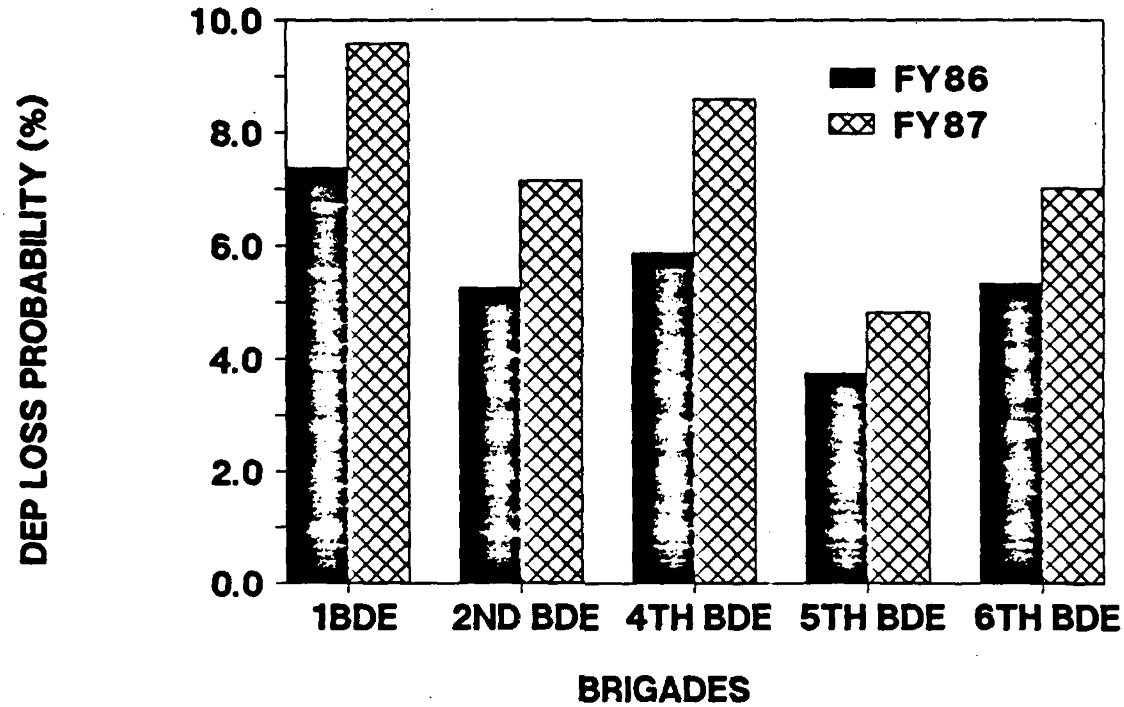

Figure 7. DEP loss probabilities for high school graduates by brigades.

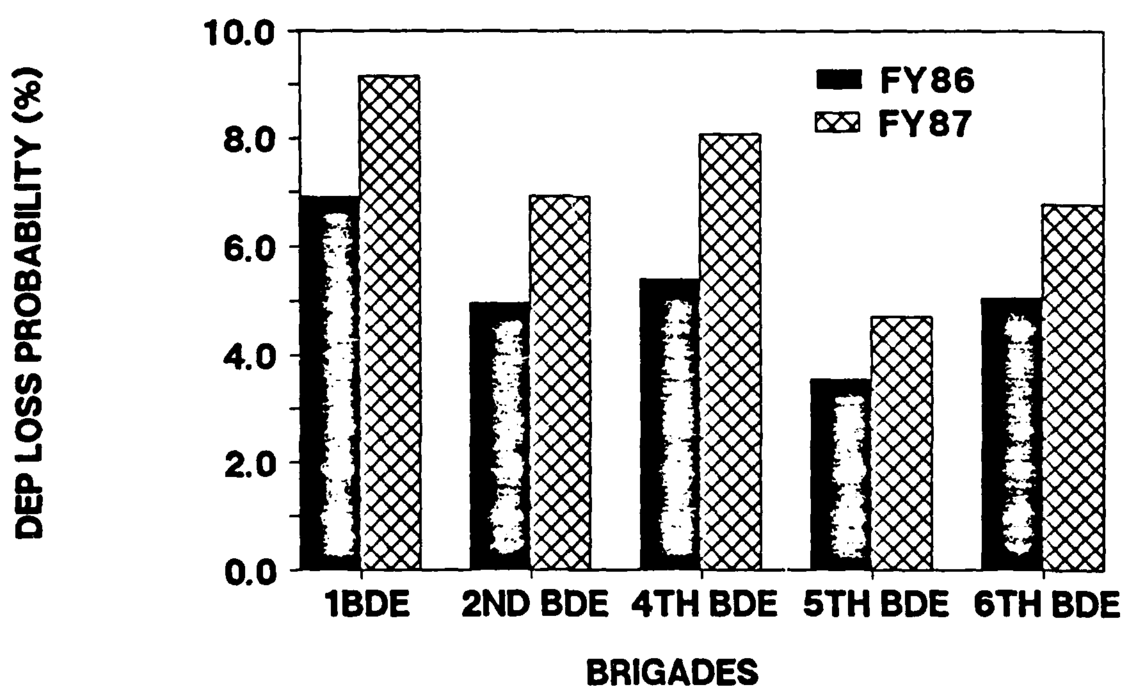

Figure 8. DEP loss probabilities for high school graduates by brigades.

note that the results for the 1st brigade exceed those of all other brigades when comparisons are made of each model within educational levels.

The recruiting brigade dummy estimated coefficients were statistically significant in seven out of eight cases. This indicated that there were differences in the probability of DEP loss among the brigades. But were there differences within the brigades? In an attempt to address this question the DEP loss behavior of selected recruiting battalions within the first brigade was examined.

DEP loss models for the Syracuse recruiting battalion and the combined recruiting battalions of Newburgh and Long Island, New York were estimated for FY87. The combination of the Newburgh and Long Island battalions is referred to as New York City since they constitute the majority of the city. The models estimated are the same as the one above except that the brigade dummies variables have been eliminated. (The estimated coefficients and standard errors for these models are report in Appendix E.)

DEP loss probabilities were estimated for high school graduates and high school seniors for various DEP lengths using the models estimated for New York City and Syracuse. This was done holding all other factors at their mean values for the entire United States (U.S.). DEP loss probabilities for various DEP length for the U.S. were also estimated.

DEP loss probabilities for New York City, Syracuse, and the entire U.S. are depicted in Figure 9 and 10 for high school graduates and high school seniors, respectively. For both high school graduates and seniors the estimated New York City DEP loss probabilities for a given DEP length exceed those of Syracuse and the U.S. DEP loss probabilities for Syracuse are less than those of total U.S. except for high school graduates with DEP lengths that exceed eleven months. These results indicate that for a given DEP length an individual in a large urban area, New York City, is more likely to be a DEP loss than someone from the general U.S. population or some small urban area, such as Syracuse, which is in the same recruiting brigade as New York City.

Conclusions

The results of the models presented here indicate that it is possible to identify characteristics of individuals more likely to abrogate their enlistment contract. Several factors -- DEP length, age, AFQT score -- are found to affect significantly the probability of becoming a DEP loss. However, the impact of age and AFQT on DEP loss are not as hypothesized. As noted earlier, other researchers have found that the job turnover rate is highest among younger individuals. Hence, as age increases the DEP loss rate should decline. It was also noted earlier that individuals with higher AFQT scores have more job options and therefore one would expect higher DEP loss probabilities. These two assumptions were not supported by the results. The impact of DEP length on DEP loss is consistent with the findings of other researchers.

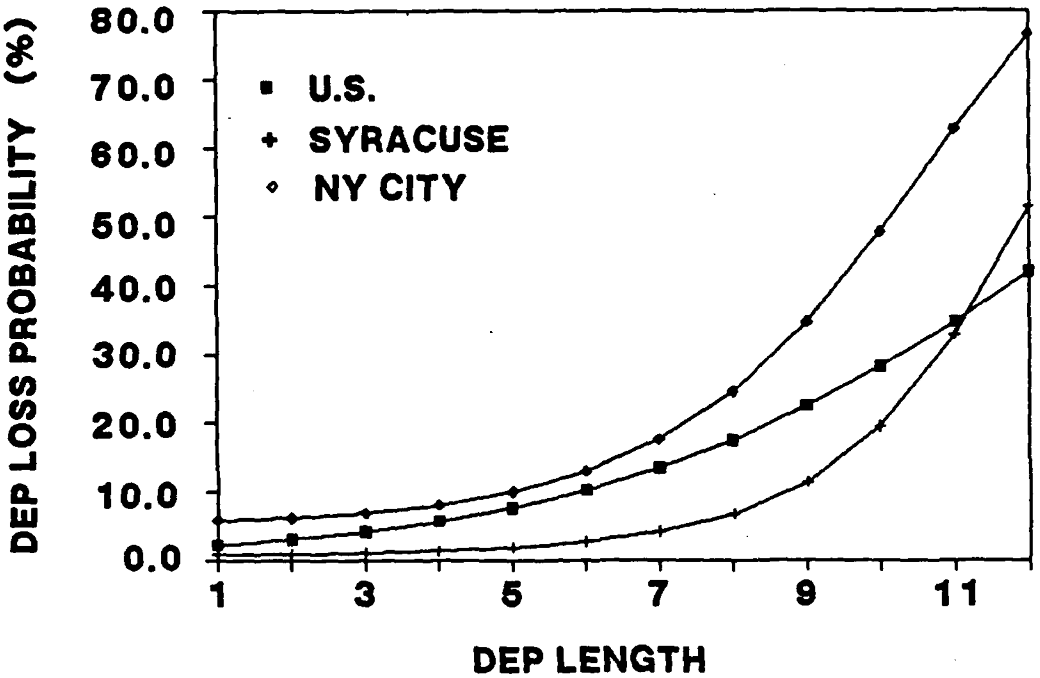

Figure 9. DEP loss probabilities for FY87 GMA contracts by DEP length for the U.S., Syracuse, and N.Y. City.

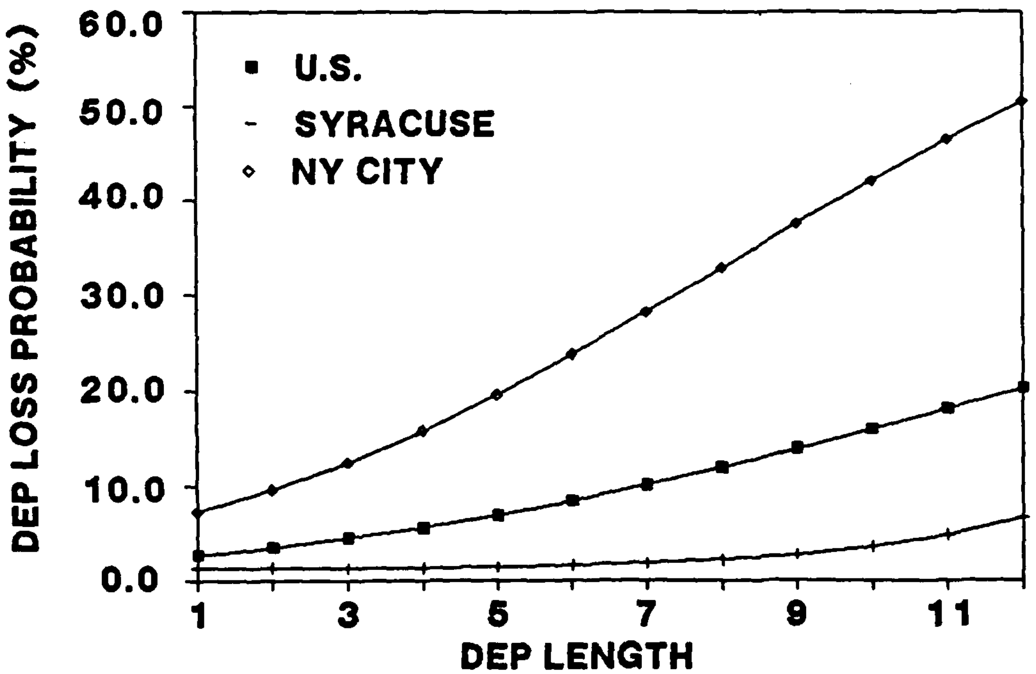

Figure 10. DEP loss probabilities for FY87 SMA contracts by DEP length for the U.S., Syracuse, and N.Y. City.

These results make it possible to identify high risk DEP loss groups. For example, high school graduates over 22 years of age with no dependents from the first brigade whose expected time in the DEP is greater than six month have a higher risk of becoming DEP losses than other graduates. Seniors have a lower probability of being a DEP loss than graduates. Seniors with no dependents from the first brigade whose DEP lengths are greater than 8.5 months are more likely to attrite from the DEP than other seniors, however.

Low risk DEP loss groups can also be identified. For example, high school graduates and seniors with no dependents from the fifth brigade whose expected time in the DEP is less than three months are far less likely to become DEP losses than other individuals.

Microdata models are estimated for selected recruiting battalions: Syracuse and the combination Newburgh and Long Island, which make up New York City. The results of these models are used to demonstrate the differences in DEP loss probabilities both within the first brigade and as compared to the U.S. as a whole. The graphical display indicates that predicted DEP loss probabilities are higher in New York City than in the Syracuse battalion or the entire U.S.

DISCUSSION

In this paper DEP loss is examined at two different levels. At the macro level the analysis indicates that the DEP loss trend is explained in part by youth unemployment, size of the DEP relative to the number of recruiters, and average DEP length. The micro analysis indicates that several factors influence individuals' decisions to abrogate their enlistment contracts. As in the macro model, DEP length is one of the significant variables. This factor is one over which the Army has control. DEP length is also related to the size of the DEP. This suggests that DEP loss can be influenced by the management of the DEP.

The results of this research can be used to identify trends which signify DEP loss rate increases. If the youth unemployment rate declines, then not only does it become more difficult to recruit high quality individuals but these individuals leave the DEP at a higher rate. Furthermore, as the size of the DEP grows relative to the number of recruiters the DEP loss rate will increase. If such trends can be identified, then it is possible to forecast periods of higher DEP losses and to implement policies to accommodate them or to ameliorate their impact.

The results of this research can lead to a more efficient and effective management of the DEP. Improved management can increase recruiter productivity and reduce recruiting cost. For example, if high risk DEP loss groups have been identified, then they can be targeted for special programs or attention. Low risk groups would not be targeted for these programs. This can lead to a more efficient allocation of recruiter time.

An obvious direction for further research would be to address management issues related to DEP. One of the findings here is that DEP length influences the probability of being a DEP loss. There are several policy

questions related to this finding. For example, is there a way to reduce these losses? Does more recruiter follow-up reduce losses? And if so, what form should the follow-up take? Should recruiters put more effort into following up individuals in the DEP or into finding new recruits? How should recruiters allocate their time? These are some examples of issues that should be addressed which could improve the management of DEP.

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APPENDIX A

Mean Values of Recruiting and DEP Loss Factors

Variable	Mean	Standard Deviation
DEP Loss Rate	7.38	2.42
Unemployment Rate (16-19)	19.23	1.14
Size of DEP per Recruiter	4.65	0.51
Average DEP length	4.34	1.86

APPENDIX B

Actual and Predicted Loss Rates and Residuals

Month-Year	Actual Loss Rate	Predicted Loss Rate	Residual
OCT83	6.2872	5.8782	0.4090
NOV83	5.5529	7.0326	-1.4797
DEC83	5.7807	6.4219	-0.6412
JAN84	5.6860	6.5284	-0.8424
FEB84	5.8803	6.8867	-1.0064
MAR84	5.6052	5.8429	-0.2377
APR84	5.7333	5.2840	0.4492
MAY84	6.5712	6.2864	0.2847
JUN84	9.0429	9.0030	0.0399
JUL84	7.3660	8.2664	-0.9004
AUG84	6.3319	8.4668	-2.1349
SEP84	6.9698	7.0363	-0.0665
OCT84	4.3947	4.5424	-0.1477
NOV84	5.2685	5.2664	0.0021
DEC84	5.5616	4.3057	1.2559
JAN85	5.6670	4.9531	0.7139
FEB85	4.9131	4.7719	0.1411
MAR85	4.9755	5.4542	-0.4788
APR85	4.5317	5.9694	-1.4377
MAY85	6.5312	6.4628	0.0684
JUN85	8.7803	9.3654	-0.5852
JUL85	7.9060	8.4135	-0.5076
AUG85	7.3359	7.6128	-0.2769
SEP85	7.0113	6.5762	0.4351
OCT85	5.7929	4.1691	1.6238
NOV85	5.1320	5.5559	-0.4239
DEC85	6.6935	6.0177	0.6758
JAN86	6.9791	7.7247	-0.7455
FEB86	5.2598	6.6316	-1.3717
MAR86	5.0559	6.5758	-1.5198
APR86	5.5278	6.3306	-0.8028
MAY86	7.3681	7.0371	0.3310
JUN86	11.7392	10.1796	1.5596
JUL86	10.0357	11.1187	-1.0829
AUG86	7.9978	9.1559	-1.1581
SEP86	8.5684	8.3883	0.1802
OCT86	6.1484	8.2288	-2.0805
NOV86	6.4258	7.5830	-1.1572
DEC86	8.1664	7.4681	0.6983
JAN87	13.3243	8.2154	5.1089
FEB87	6.9219	7.7903	-0.8684
MAR87	7.5709	7.4074	0.1635
APR87	11.0681	7.8023	3.2659
MAY87	9.1442	7.8410	1.3032
JUN87	13.6669	12.3304	1.3366
JUL87	12.4404	13.5289	-1.0886
AUG87	10.9442	10.8559	0.0884
SEP87	12.6726	10.3239	2.3486

APPENDIX C

Means of Factors for FY86 and FY87 by Brigade

Variable	FY86	FY87
	BRIGADE 1	
DEP LOSS	0.10000560	0.11553757
AGE	19.88908165	19.71566539
AFQT SCORE	71.42738821	71.22518108
DEP LENGTH	5.09871845	5.29654879
SENIORS	0.37903632	0.41989774
ACF YES	0.48816386	0.40164749
BONUS YES	0.30219934	0.17419401
NO DEPENDENTS	0.92982260	0.93168584
TERM 2	0.19760479	0.21389007
TERM 3	0.36504561	0.37494674
	BRIGADE 3	
DEP LOSS	0.08214697	0.09296738
AGE	20.00720906	19.95457193
AFQT SCORE	69.53868056	69.47240827
DEP LENGTH	4.67619798	4.70529994
SENIORS	0.35009390	0.35760047
ACF YES	0.50578542	0.37936808
BONUS YES	0.37741564	0.21665696
NO DEPENDENTS	0.86799540	0.86517181
TERM 2	0.18010541	0.19867501
TERM 3	0.32458957	0.35439720
	BRIGADE 4	
DEP LOSS	0.06573896	0.06639958
AGE	20.54764190	20.64908376
AFQT SCORE	70.69817658	70.48401217
DEP LENGTH	4.29414587	4.02396320
SENIORS	0.27070195	0.25016693
ACF YES	0.50205648	0.37510201
BONUS YES	0.39402248	0.23102604
NO DEPENDENTS	0.82197697	0.81126196
TERM 2	0.16397039	0.16062022
TERM 3	0.34480395	0.39045923
	BRIGADE 5	
DEP LOSS	0.08668067	0.10593331
AGE	19.81489261	19.65897824
AFQT SCORE	71.38418999	71.40374680
DEP LENGTH	5.21151455	5.42013255
SENIORS	0.38620483	0.41517508
ACF YES	0.51313928	0.43140427
BONUS YES	0.33013246	0.18196525
NO DEPENDENTS	0.89381404	0.90283359
TERM 2	0.20992841	0.22449512
TERM 3	0.34209285	0.36826175
	BRIGADE 6	
DEP LOSS	0.08137018	0.09089486
AGE	20.21157519	20.20355437
AFQT SCORE	71.53673755	71.78478040
DEP LENGTH	4.64707755	4.69842637
SENIORS	0.34273526	0.34024896
ACF YES	0.53998472	0.44218273
BONUS YES	0.36903094	0.18860096
NO DEPENDENTS	0.89207946	0.89250763
TERM 2	0.15363555	0.17411728
TERM 3	0.39036037	0.41846082

APPENDIX D

Battalion Microdata Models

Table D1

Results of Microdata Model for New York City during FY87

Variable	Estimated Coefficient	Standard Error
Intercept	-11.010*	2.548
Age	0.548*	0.204
Age Squared	-0.008**	0.004
DEP Length	-0.044	0.130
DEP Length Squared	0.031*	0.012
AFQT	-0.010**	0.005
Senior	-0.352	0.962
ACF_YES	-0.070	0.180
Bonus_Yes	0.313	0.218
Depend_No	1.468*	0.428
Term_3	0.177	0.178
Term_2	0.277	0.237
DEP Length *Senior	0.372	0.274
DEP Length Squared* Senior	-0.038**	0.019

FRACTION OF CONCORDANT PAIRS OF PREDICTED PROBABILITIES AND RESPONSES: 0.71
R = 0.303
MODEL CHI-SQUARE = 175.72 WITH 13 D.F.
(-2 LOG L.R.) P = 0.0 .

* Significant at the .01 level.
** Significant at the .05 level.

Table D2

Results for Microdata Model for the Syracuse Recruiting Battalion during FY87

Variable	Estimated Coefficient	Standard Error
Intercept	-16.404	23.881
Age	0.158	0.357
Age Squared	0.001	0.018
DEP Length	-0.005	0.199
DEP Length Squared	0.034**	0.016
AFQT	-0.002	0.007
Senior	1.399	1.173
ACF_YES	0.108	0.250
Bonus_Yes	0.202	0.280
Depend_no	9.256	23.511
Term_3	0.037	0.239
Term_2	0.110	0.313
DEP Length*Senior	-0.104	0.344
DEP Length Squared* Senior	-0.014	0.024

FRACTION OF CONCORDANT PARIS OF PREDICTED PROBABILITIES AND RESPONSES: 0.74
R = 0.336.
MODEL CHI-SQUARE = 145.92 WITH 13 D.F.
(-2 LOG L.R.) P = 0.0.

** Significant at the .05 level.